**STSE: The Question of Biofuels**

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| **Course:** Grade 11 Academic Biology | **Course Code:** SBI3U |
| **Unit Title:** Plants | **Topic:** Biofuels |
| **Lesson Title:** The Question of Biofuels | |
| **Category:** Relationships Amongst Sciences, Technologies, Societies, and Environments | |

**Curriculum Expectations addressed:**

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| Big Ideas: Plant variety is critical to the survival and sustainability of ecosystems.  F1.1 evaluate, on the basis of research, the importance of plants to the growth and development of Canadian society  A1.9 analyse the information gathered from research sources for logic, accuracy, reliability,  adequacy, and bias |

**Assessment Tasks/Activities, Strategies and Recording Devices:**

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| **Tasks/Activities** | **Assessment Strategies** | **Assessment Types** | **Recording Devices** |
| Jigsaw Activity  Produce Action Plan | Observation  Review of Action Plans/  Worksheets | A for L  A as L | 3-2-1 sheet  Teacher notes |

**Instructional Focus:**

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| **Teaching/Learning Strategies:**   * Think Pair Share (TPS) * Jigsaw * 4 Corners (seated) | **Student Groupings:**   * Pairs * 8 groups of 4 of mixed ability * Whole class |
| **Differentiation Strategies:**   * Each expert group has a resource with a different focus (differentiation for interest). * Resource length can be adjusted further if necessary. * Both visual and verbal texts are critically examined (differentiation for learning style). | |
| **Adaptations/Accommodations for Exceptional Students:**   * Class space should facilitate easy movement for all students. * Students with learning disabilities involving writing should participate in discussion and will receive notes later from teacher. | |

**Notes and Reminders**

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| * Activity involves complex group work. * Requires photocopying (2 handouts/student) and use of LCD projector and computer. |

**Sources**

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| Resources:  1. Daynard, Karen, and Terry Daynard. “What are the Effects of Biofuels and Bioproducts on the Environment, Crop and Food Prices and World Hunger?” KD Communications, April 2011. Web. 29 December 2011.  2. Canadian Renewable Fuels Association. “Ethanol Key Issues: Fact Sheet/Responses to Key Issues for Canada’s Ethanol Industry.” Canadian Renewable Fuels Association, August 2011. Web. 29 December 2011.  3. Coolman, Robert. “Green Gasoline Comes Closer to Fueling Your Car.” *LiveScience*, 29 July 2011. Web. 29 December 2011.  4. Robenthal, Elisabeth. “Rush to Use Crops as Fuel Raises Food Prices and Hunger Fears.” *New York Times*, 6 April 2011. Web. 29 December 2011.  Photo resources selected from the first page of a Google Images search for “Biofuel Poster.” | | | | |
| **Lesson Outline** | | | | |
| Objectives (learning goals):   * By the end of the class, students will be able to…   + …based on information, state some merits and some drawbacks of biofuel use.   + …state the bias in informational text and note how they recognize it.   + …based on information, suggest actions to be taken by the Canadian government regarding biofuels. | | | | |
|  | **Minds On** | * Students watch short video on biofuels. <http://www.youtube.com/watch?v=t_Fw6y4T3Po> * Ask students to TPS what they already knew/learned from video. * Discuss **bias** in film and how to detect it. * Introduce action plan as goal of lesson (see Teacher notes) | **Materials and Resources Required**   * Student handouts * Computer + LCD projector | |
| 10 |
|  | **Action** | * This is a **jigsaw** activity. Move students into home groups. * Each student in a home group gets a resource labeled 1-4 and either a or b. * Students will move to their expert groups according to resource number and letter. * Each student spends **15 minutes** reading his/her resource and completing a 3-2-1 activity: * Students in expert groups now spend **10 minutes** discussing their common resource and their 3-2-1 answers. * Students move back to their home groups and explain main points of their resource to their group one at a time beginning with resource 1. All other students take notes in the remaining squares of their Appendix 2 handout (**15 minutes**). * Each home group prepares a short report about their findings and what action the government should take regarding biofuels (**15 minutes**). (Refer to Reverse Appendix 2) | | |
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|  | **Consolidation and Debrief** | * The government is looking for inspiration for a biofuel poster campaign. Show students images in Appendix 3 on LCD projector (seated 4 corners activity). Ask students to first think of which one(s) should they seek to emulate and why (TPS). | |  |
| 10 |
|  | **Next Steps** | * For homework, look up at least one of the things you need more information about from 3-2-1 activity * If students are really interested, consider sending a revised and edited copy of the report to government officials. | |
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**Teacher Notes**

Lesson Plan: The Question of Biofuels

Grade and Unit: Grade 11 - Plants: Anatomy, Growth, and Function

Content:

Minds On: (**10 minutes)**

1. Students watch short video on biofuels. <http://www.youtube.com/watch?v=t_Fw6y4T3Po>
2. Ask students to TPS what they already knew in the video and what they had never heard before. Discuss **bias** in film and how to detect it.
3. Activity set-up: The Harper government has received a lot of criticism for not being “green” enough, so it has hired this class as a consultant on the issue of biofuels. It has asked the class to prepare reports that summarize the usefulness of biofuels and a suggestion of next steps.

Action:

1. This is a **jigsaw** activity. Seat students in 8 home groups of 4 students each (32 total). Note: Have mixed ability groupings done before class for both expert and home groups.
2. Each student in a home group gets a resource labeled 1-4 and either a or b.
3. Students will move to their expert groups where each student has the same resource according to their number and letter (1a, 1b, 2a, 2b, etc). Note: the resource for a and b groups is the same; the split according to letter is to keep groups to 4 students.
4. Each student spends **15 minutes** reading his/her resource and completing a 3-2-1 activity:

* 3-2-1: 3 things that you find extremely important to the resource, 2 things that you do not understand very well/need more clarification for, and 1 thing you think show the bias within the resource. (Refer to Appendix 1)

Note: Each student handout is half a page

1. Students in expert groups now spend **10 minutes** discussing their common resource and their 3-2-1 answers. They fill in their resource’s square on their handouts. (Refer to Appendix 2)
2. Students move back to their home groups and explain main points of their resource to their group one at a time beginning with resource 1. All other students take notes in the remaining squares of their Appendix 2 handout (**15 minutes**).
3. Each home group prepares a short report about their findings and what action the government should take regarding biofuels (**15 minutes**). Each student should record group answers on his or her own sheet. (Refer to Reverse Appendix 2)

Consolidation: (**10 minutes**)

1. The government is looking for inspiration for a biofuel poster campaign. Show students images in Appendix 3 on LCD projector (seated 4 corners activity). Ask students to first think of which one(s) should they seek to emulate and why, and then share that opinion with one person in their home group.
2. **Next Steps:** For homework, look up at least one of the things you need more information about from 3-2-1 activity; we’ll discuss tomorrow. If students are really interested, consider sending a revised and edited copy of the report to government officials.

Note: Teacher should collect Appendix 2 handout and give formative feedback on students’ action plan based on logic. After students have discussed the information they looked up for homework (as stated in previous step) teacher should collect 3-2-1 sheet and give formative feedback on students’ ability to detect bias.

Resources:

1. What are the Effects of Biofuels and Bioproducts on the Environment, Crop and Food Prices and World Hunger? (2 pages-information heavy)

2. Canadian Renewable Fuel Association Fact Sheet. (2 pages information heavy)

3. Green Gasoline Comes Closer to Fueling Your Car. (1.5 pages)

4. World Hunger fears. (2.5 pages)

Lengths of readings can be adjusted according to class needs.

****Biofuels\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Appendix 2 2

🡪 Record the important information for each resource in the boxes below. Fill in your section during your expert group discussion and the other boxes during your home group discussion.

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| **Resource 1: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | **Resource 2: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
| **Resource 3: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | **Resource 4: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |

Biofuels – Action Plan\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Reverse Appendix 2 2

🡪 Use the information you have collected to complete the following report. Please discuss your action plan as a group and each record your facts and suggestions.

**Attn: Jim Bradley, Minister of the Environment; and Gerry Ritz, Minister of Agriculture**

Given that: (List three important facts that affected your decision-making.)

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
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3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

We recommend that: (List two steps the government should take in light of your findings.)

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Signed,

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Biofuels\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Appendix 1 1

3-2-1 Activity 🡪 While reading your resource in your expert group, find:

* 3 things that you find extremely important to the resource,
* 2 things that you do not understand very well/need more clarification for,
* 1 thing you think shows the bias within the resource

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Biofuels\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3-2-1 Activity 🡪 While reading your resource in your expert group, find:

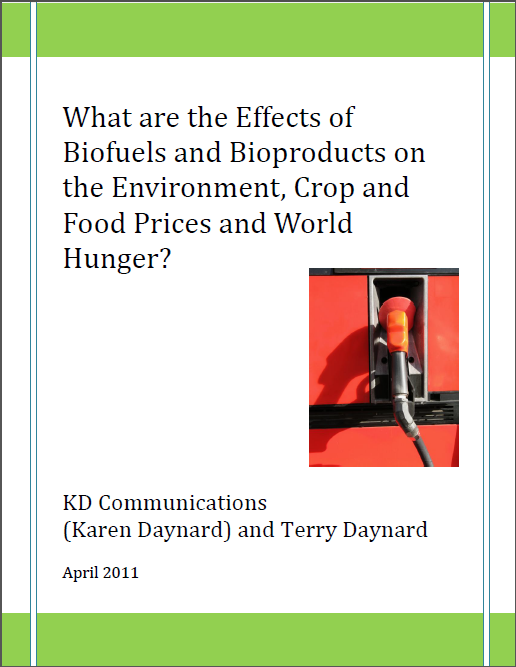
* 3 facts that you find extremely important to the resource’s message,
* 2 things that you do not understand very well/need more clarification for,
* 1 thing you think shows the bias within the resource

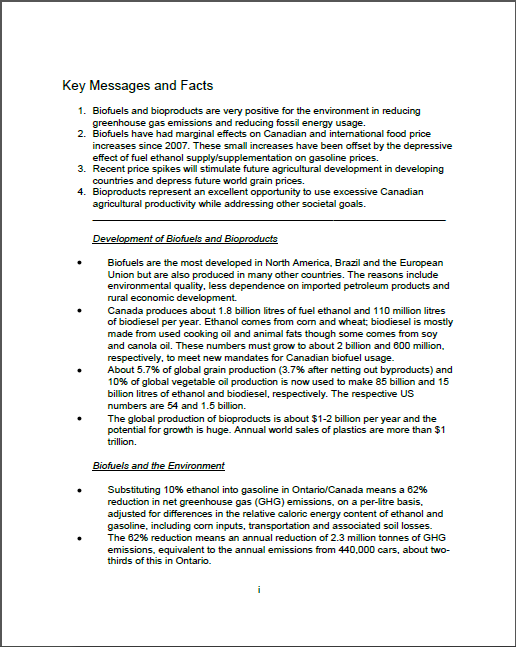
Possible Posters:

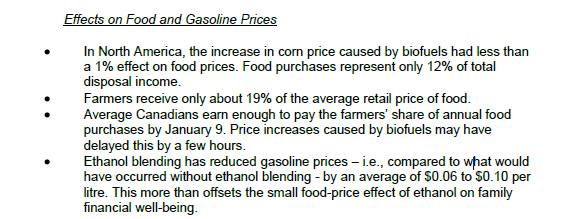
Appendix 3

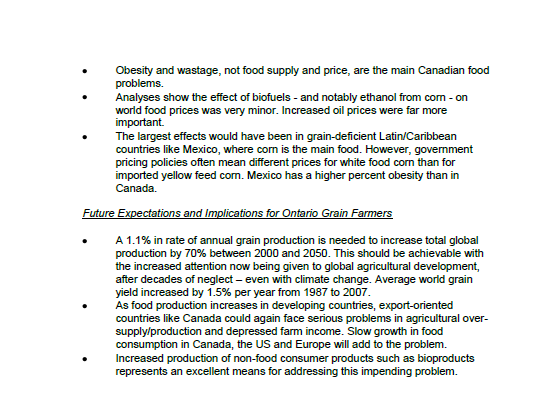
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| [http://t0.gstatic.com/images?q=tbn:ANd9GcRIJrbPGBtBZrO4vKTkD7mJ9g_f0jxBg8px__aJkP8CMqHrJY8SAQ](http://images.google.ca/imgres?q=biofuel+poster&hl=en&rlz=1T4GGHP_en-GBCA450CA450&biw=1040&bih=640&tbm=isch&tbnid=MBjEpCMt4_41bM:&imgrefurl=http://johnansell.wordpress.com/2011/08/11/monckton-greenpeace-nasa-and-nazis/&docid=XrJxsQ3NkZ2yUM&imgurl=http://johnansell.files.wordpress.com/2010/03/climate-change-no-downside-to-biofuel1.jpg?w=470&h=352&w=470&h=352&ei=hEfyTtanAoXz0gHN5ICXAg&zoom=1) | [http://t2.gstatic.com/images?q=tbn:ANd9GcRXK4GkQBvijY6gj1pqd3rNYkhbsRK3QwjmBDmGY8zz_MmMbv0D](http://images.google.ca/imgres?q=biofuel+poster&hl=en&rlz=1T4GGHP_en-GBCA450CA450&biw=1040&bih=640&tbm=isch&tbnid=ZcmSWjC0ZAOiJM:&imgrefurl=http://turta.myblog.it/index-3.html&docid=UuUqJ2ZgImk9yM&imgurl=http://www.ridelust.com/wp-content/uploads/bio_fuel_conversion_chart.jpg&w=455&h=523&ei=hEfyTtanAoXz0gHN5ICXAg&zoom=1) |

Resource 1

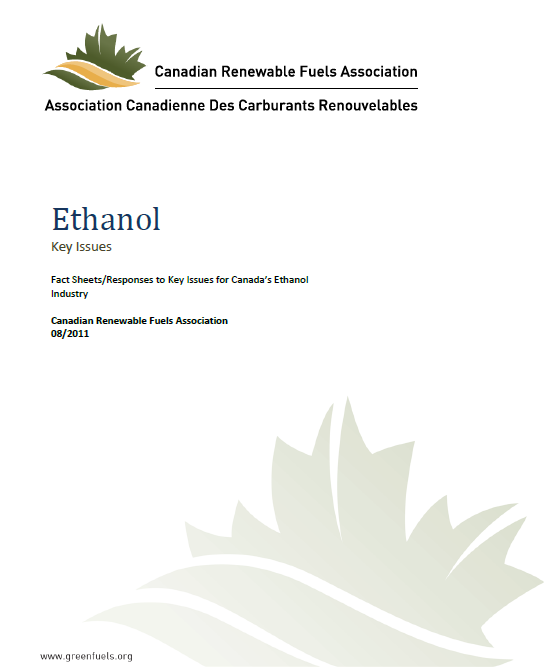




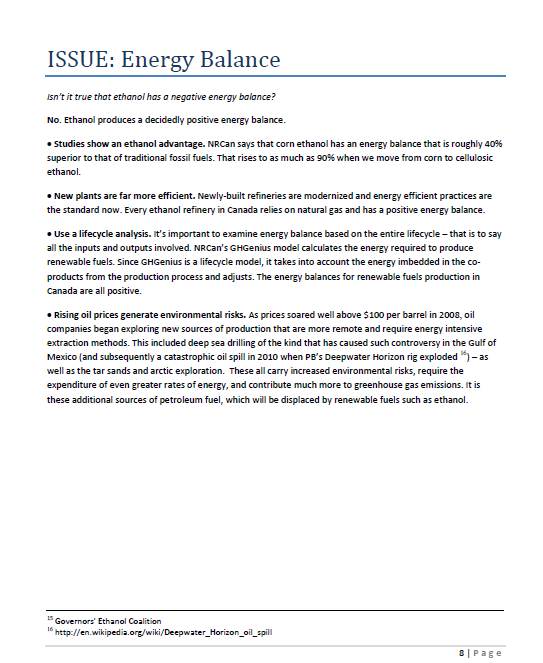




Resource 2







Resource 3:

**Green Gasoline Comes Closer to Fueling Your Car**

Robert Coolman, University of Massachusetts, Amherst

Date: 29 July 2011 Time: 02:11 PM ET

www.LiveScience.com



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| [nsf, national science foundation, behind the scenes, energy, green technology, gasoline, biofuels, catalysis, green gasoline, George Huber, Robert Coolman](javascript:void(0);) |
| George Huber poses with a vial of green gasoline compounds. CREDIT: Ben Barnhart |

*This Behind the Scenes article was provided to LiveScience in partnership with the National Science Foundation.*

The backbone of our energy infrastructure is carbon-based fuel. In the form of oil, coal and natural gas, carbon runs our cars, heats our homes and cooks our food. We can minimize the shock of transitioning away from fossil fuels to sustainable sources by using as much existing carbon-based infrastructure as possible.

Plants are the only source of sustainable carbon, in that there are no other means to simply capture carbon from the air to make carbon-based fuel. That is the beauty of plant-based biofuels and why they must have a role in our sustainable-energy future.

All life is carbon based. To convert plant-based carbon into fuels we can use in our cars, we must first understand the composition of the plants.

**Plants as energy**

First, think of how your body stores energy as fat but is structurally composed of a different type of molecule called protein; plants have a similar dichotomy. A plant stores energy as starch, sugar and fat, but is structurally composed of lignin and cellulose (or 'lignocellulose'). Take corn as an example: from kernels comes starch and sugar that can be fermented to make ethanol; corn oil can be used to make biodiesel.

While those technologies deserve study in their own right, we mustn't ignore the remaining cobs, husks and stalks — the structural materials made of lignin and cellulose. Wood and grass are made of the same structural materials.

The structural materials of plants are the cheapest and most abundant forms of biomass available — plus humans can't eat them (cows and beavers can, only because their guts have special bacteria). Fuel made from inedible material has the benefit of never directly interfering with food production.

**Green gasoline**



Vials containing sawdust, catalyst, charred catalyst and gasoline made from sawdust.  
CREDIT: Robert Coolman, UMass Amherst

Research conducted at the University of Massachusetts, Amherst headed by George Huber focuses on converting sawdust and switchgrass into "green gasoline" — a fuel that we can use within our current infrastructure. In a few years you may start seeing it blended with what you buy at the pump.

"Unless there's a sign that tells you so, you won't even know your gas is 'green,'" said Huber. "It has zero carbon footprint. The CO2 [carbon dioxide] from your car is recycled to the plant when it re-grows."

Resource 4

Rush to Use Crops as Fuel Raises Food Prices and Hunger Fears



Agnes Dherbeys for The New York Times

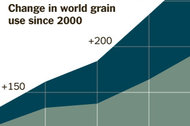
Farmers in Thailand face a surging demand for cassava, a fairly new crop for biofuel production.

By [ELISABETH ROSENTHAL](http://topics.nytimes.com/top/reference/timestopics/people/r/elisabeth_rosenthal/index.html?inline=nyt-per)

Published: April 6, 2011

Top of Form

The starchy cassava root has long been an important ingredient in everything from tapioca pudding and ice cream to paper and animal feed.

[[](javascript:pop_me_up2('http://www.nytimes.com/imagepages/2011/04/07/world/20110407_cassava_graphic.html?ref=earth','776_762','width=776,height=762,location=no,scrollbars=yes,toolbars=no,resizable=yes'))](javascript:pop_me_up2('http://www.nytimes.com/imagepages/2011/04/07/world/20110407_cassava_graphic.html?ref=earth','776_762','width=776,height=762,location=no,scrollbars=yes,toolbars=no,resizable=yes'))But last year, 98 percent of cassava chips exported from [Thailand, the world’s largest cassava exporter](http://webapp.ciat.cgiar.org/asia_cassava/pdf/proceedings_workshop_00/25.pdf), went to just one place and almost all for one purpose: to China to make biofuel. Driven by new demand, Thai exports of cassava chips have increased nearly fourfold since 2008, and the price of cassava has roughly doubled.

Each year, an ever larger portion of the world’s crops — cassava and corn, sugar and palm oil — is being diverted for [biofuels](http://topics.nytimes.com/top/reference/timestopics/subjects/b/biofuels/index.html?inline=nyt-classifier) as developed countries pass laws mandating greater use of nonfossil fuels and as emerging powerhouses like China seek new sources of energy to keep their cars and industries running. Cassava is a relatively new entrant in the biofuel stream.

But with [food prices](http://topics.nytimes.com/top/reference/timestopics/subjects/f/food_prices/index.html?inline=nyt-classifier) rising sharply in recent months, many experts are calling on countries to scale back their headlong rush into green fuel development, arguing that the combination of ambitious biofuel targets and mediocre harvests of some crucial crops is contributing to high prices, hunger and political instability.

This year, the [United Nations](http://topics.nytimes.com/top/reference/timestopics/organizations/u/united_nations/index.html?inline=nyt-org) Food and Agriculture Organization [reported that its index of food prices](http://www.fao.org/worldfoodsituation/wfs-home/foodpricesindex/en/) was the highest in its more than 20 years of existence. Prices rose 15 percent from October to January alone, potentially “throwing an additional 44 million people in low- and middle-income countries into poverty,” [the World Bank said](http://tinyurl.com/3mu35gj).

Soaring food prices have caused riots or contributed to political turmoil in a host of poor countries in recent months, including Algeria, Egypt and Bangladesh, where palm oil, a common biofuel ingredient, provides crucial nutrition to a desperately poor populace. During the second half of 2010, the price of corn rose steeply — 73 percent in the United States — an increase that the United Nations [World Food Program](http://topics.nytimes.com/top/reference/timestopics/organizations/w/world_food_program/index.html?inline=nyt-org) [attributed in part](http://usa.wfp.org/news-story/rising-food-prices-10-questions-answered) to the greater use of American corn for bioethanol.

“The fact that cassava is being used for biofuel in China, rapeseed is being used in Europe, and sugar cane elsewhere is definitely creating a shift in demand curves,” said [Timothy D. Searchinger](http://tinyurl.com/42ytwux), a research scholar at [Princeton University](http://topics.nytimes.com/top/reference/timestopics/organizations/p/princeton_university/index.html?inline=nyt-org) who studies the topic. “Biofuels are contributing to higher prices and tighter markets.”

…

Olivier Dubois, a bioenergy expert at the Food and Agriculture Organization in Rome, said it was hard to quantify the extent to which the diversions for biofuels had driven up food prices.

“The problem is complex, so it is hard to come up with sweeping statements like biofuels are good or bad,” he said. “But what is certain is that biofuels are playing a role. Is it 20 or 30 or 40 percent? That depends on your modeling.”

While no one is suggesting that countries abandon biofuels, Mr. Dubois and other food experts suggest that they should revise their policies so that rigid fuel mandates can be suspended when food stocks get low or prices become too high.

“The policy really has to be food first,” said [Hans Timmer](http://econ.worldbank.org/external/default/main?authorMDK=517433&theSitePK=476883&piPK=64214942&pagePK=64214821&menuPK=64214916), director of the Development Prospects Group of the [World Bank](http://topics.nytimes.com/top/reference/timestopics/organizations/w/world_bank/index.html?inline=nyt-org). “The problems occur when you set targets for biofuels irrespective of the prices of other commodities.”

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More distant or indirect impacts are considered to be likely, however. Because cassava chips have been commonly used as animal feed, new demand from the biofuels industry might affect the availability and cost of meat. In Southeast Asian countries where China is paying generously for stockpiles of cassava, [farmers may be tempted to grow the crop](http://www.un-energy.org/publications/709-bioenergy-and-food-security-analysis-for-thailand) instead of, for example, other vegetables or rice.

“This is becoming a more valuable cash crop,” Mr. Harris said. “The farmland is limited, so the more that is devoted to fuel, the less is devoted to food.”

Biofuels development in wealthier nations has already proved to have a powerful effect on the prices and the cultivation of crops. Encouraged by national biofuel subsidies, nearly 40 percent of the corn grown in the United States now goes to make fuel, with prices of corn on the [Chicago Mercantile Exchange](http://topics.nytimes.com/top/reference/timestopics/organizations/c/chicago_mercantile_exchange/index.html?inline=nyt-org) rising 73 percent from June to December 2010.

Such price rises also have distant ripple effects, food security experts say. “How much does the price of corn in Chicago influence the price of corn in Rwanda? It turns out there is a correlation,” said Marie Brill, senior policy analyst at [ActionAid](http://www.actionaid.org/index.aspx), an international development group. The price of corn in Rwanda rose 19 percent last year.

“For Americans it may mean a few extra cents for a box of cereal,” she said. “But that kind of increase puts corn out of the range of impoverished people.”

Higher prices also mean that groups like the World Food Program can buy less food to feed the world’s hungry.

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